**The Galvanic Cell**

Name:\_\_\_\_*TEACHER SOLUTION*\_\_ Date:\_\_Friday, February 24/2012\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| **5/K/U** | **3/T/I** | **3/A** | **7/C** |

***Purpose:*** Understand the fundamental principles behind building and working of the Galvanic

cell.

***What You Will Need:***

*Chemicals*

* 30 ml of 0.1M Pb(NO3)2.
* 30 ml of 0.1M Cu(NO3)2.
* 30 ml of 0.1M Zn(NO3)2.
* 80 ml of 0.2M KNO3.
* 30 ml of 0.1M FeCl3.

*Materials/Equipment*

* Voltmeter with alligator clips.
* 5 rectangular strips of filter paper.
* 5x 50 ml beakers.
* 1x 250 ml beaker.
* Iron nail, copper strip, lead strip, and zinc strip.

***Lab Procedure***

All solutions have been provided and no preparation is required. The beakers of different solution must be set up as shown:

Pb(NO3)2

Zn(NO3)2

KNO3

Cu(NO3)2

FeCl3

In order to make a full cell reaction occur, a salt bridge must be used. To do this, a strip of filter paper must be soaked in the excess KNO3 solution, then placed between two adjoining beakers and must be touching each solution. An example is as follows:

Once the salt bridge is in place, attach the piece of metal to the alligator clip, and submerge the metal into the corresponding salt solution. Measure the potential difference and record it in *Table 1.*

***Observations:***

**6T/I & 6 K/U**

Table 1: The potential difference measured for the corresponding Galvanic cell.

|  |  |  |  |
| --- | --- | --- | --- |
| Solution #1 | Solution #2 | Measured Potential Difference (V) | Calculated Potential Difference (V) |
| Zn(NO3)2 | Cu(NO3)2 | *0.85* | *1.10* |
| Cu(NO3)2 | Pb(NO3)2 | *0.50* | *0.47* |
| Cu(NO3)2 | FeCl3 | *0.46* | *0.37* |
| Zn(NO3)2 | Pb(NO3)2 | *0.43* | *0.63* |
| Zn(NO3)2 | FeCl3 | *0.44* | *0.73* |

***Questions***

1. Draw a diagram of one of the Galvanic cells that you made during this laboratory in the box

below. Label the following in the diagram: the cathode, the anode, direction of current flow.

**4 K/U**

e-

Zn(NO3)2

KNO3

Cu(NO3)2

Cathode

Anode

2. Compare your measured potential differences to the ones that you calculated in *Table 1.* Were

they the same? Why or why not? Suggest possible sources of error which could/did contribute

to the source of error. **3 T/I**

\_\_*In general most of the measured differences were similar to that of the calculated ones.\_\_\_\_*

*Calculated values will always be in the “ideal” environment and therefore measurable values*

*\_will be subject to sources of error. Possible sources of error include contamination of the*

*\_metals and possibly the solutions. Unclean beakers and faulty equipment may also contribute.*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Answers will vary\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

3. Predict other variables that could be manipulated in this experiment (Give a minimum of 2).

Describe an investigation that you could complete to test your prediction. **2 A & 4 C**

*\_Answers will vary. You could test how concentration and volume affects the electrochemical*

*\_measurements. To test the effects of concentration on measurements, you could measure the\_*

*\_standard solution concentration given by the teacher then prepare concentrations both\_\_\_\_\_*

*higher and lower and take the measurements. The same could be done for volume.\_\_\_\_\_\_\_\_\_*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Your teacher was conducting the same laboratory and obtained the following values for

his/her experiment.

Table 1: Sample data collected by your teacher.

|  |  |  |
| --- | --- | --- |
| Cathode | Anode | Measured Potential Difference (V) |
| Pb(NO3)2 | Cu(NO3)2 | - 0.50 V |
| Zn(NO3)2 | Pb(NO3)2 | - 0.34 V |

Using the knowledge that you have obtained from the experiment, speculate as to why the values obtained were negative. **1 K/U & 1 A**

\_*The teacher connected the cathode and anode to the wrong metals. The connections should*\_

\_*be switched. The teacher should have looked at the Eo values to determine which metal was*

\_*connected to the cathode and which metal is connected to the anode.*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. You were asked to make a battery for a new prototype car that was being designed by Ford.

Based on your experimental data, which galvanic cell would you pick and why? **3C**

\_*Based on my experimental data, I would choose the Cu(NO3)2 and Zn(NO3)2 cell because \_*\_

\_\_*it produces the highest potential output compared to the other electrochemical cells.*\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_